NASA Science Mission Directorate - Applied Sciences Program

Disaster Management – Fiscal Year 2005 Annual Report [*]

SUMMARY

The Disaster Management program element assisted with the NASA response to specific disasters in FY05, and the program's activities addressed the integration of NASA Earth science results into preparations and decision support for a wide range of disasters, such as wildfires, earthquakes, flooding, hurricanes, landslides, and droughts. The program developed numerous evaluation, validation and verification, and benchmark reports, and the program added 5 projects from the *Decisions* solicitation to its portfolio.

The NASA Short-term Prediction Research and Transition Center (SPoRT), located at NASA-Marshall and supported by the Earth-Sun System Division and the Disaster Management Program element, received a 2005 NASA Group Achievement Award for improving the Nation's weather prediction capabilities through the use of NASA-developed satellite data and forecasting technology in the National Weather Service Forecast Office environment.

MAJOR ACCOMPLISHMENTS

Support to East Asian Tsunami Response

NASA, through the Disaster Management program and other efforts, provided support to the U.S. response to the East Asian Tsunami in December 2004. The Disaster Management program supported NASA's efforts to coordinate with interagency efforts, providing high-resolution ocean and land-cover measurements from EO-1, Landsat, and MODIS space-based instruments that emergency relief organizations could use to identify some of the hardest hit areas and to assess the extent of the damage.

Support to Hurricane Katrina Response

NASA, through the Disaster Management program and other efforts, provided support to the response to Hurricane Katrina in August and September 2005. Among the Disaster Management program's activities, the Socioeconomic Data and Applications Center (SEDAC) User Working Group disseminated preliminary gridded dataset on population and housing characteristics for Alabama, Louisiana, and Mississippi based on the 2000 census (resolution of 30 arc seconds). The team provided this dataset to the National Institute of Environmental Health Sciences (NIEHS) for evaluation and use in the federal response and planning related to the public health and environmental effects of Hurricane Katrina. The team also prepared a grid for the New Orleans metropolitan statistical area at 7.5' resolution (about 250 m). The University Consortium for Geographic Information Science (UCGIS) and the American Sociological Association provided links to these datasets.
http://beta.sedac.ciesin.columbia.edu/katrina2005.html

SENH Results

In May 2005, the Disaster Management program element held a workshop for the ten Solid Earth and Natural Hazards (SENH) projects, which were funded in 2001 from a legacy effort under the former Hazards Program and are scheduled for completion in FY06. The Disaster Management program worked with the U.S. Geological Survey (USGS) EROS Data Center (EDC) to host a review of the SENH applications projects. The review included technical progress reports from all ten project teams,

[*] The FY05-09 Disaster Management Program Element Plan is available through: *http://aiwg.gsfc.nasa.gov/dss.html*

discussions of the alignment of the SENH projects with the Applied Sciences program, and a number of special presentations by EDC staff about USGS Disaster Management and Natural Hazards activities. The results of this workshop encouraged the principal investigators to fit their results to the systems engineering approach; final reports are expected in FY06.

Subcommittee on Disaster Reduction

The Disaster Management program has been very active in the Subcommittee on Disaster Reduction (SDR). The Disaster Management program manager is co-chair of the Remote Sensing Applications Working Group, which changed its name in FY05 to the Earth Observation Working Group (EOWG). NASA team members participated in the Grand Challenges review, and SDR published the final *Grand Challenges Report*. In FY06, the project team will proceed with the specific implementation plans for each Grand Challenge. *http://www.sdr.gov*

WSSD/CEOS

The Disaster Management program continued to support the World Summit on Sustainable Development (WSSD) Type-2 Partnerships in Disaster Management and Conflict, which satisfies the WSSD goals as highlighted in the Committee on Earth Observation Satellites (CEOS) Module III guidelines. The program initiated a partnership with the European Global Monitoring for Environment and Security (GMES) and European Space Agency's TIGER effort. Together with Mississippi State University and the University of South Carolina, the program established African projects using NASA data. In FY05, the program initiated a collaborative project focused on sustainable development opportunities in Africa. The initial phase of the project, scheduled for completion in FY06, seeks to identify NASA science capacity that could contribute to the Disaster Management and Conflict Module of the CEOS Follow-Up Program. The project team developed a survey instrument to identify decision support system opportunities and NASA research projects that may contribute to the WSSD effort.

Hazards U.S. Multi-Hazard (HAZUS-MH) Project

Work on Year 2 of the HAZUS-MH project continued in collaboration with the National Institute of Building Sciences (NIBS) and Applied Research Associates (ARA). This project seeks to improve the coastal risk assessment methodology in the HAZUS-MH decision support system through the integration of NASA modeling and remote sensing tools. In December 2004, NASA and ARA presented results of the technical work accomplished during Year 1 to the Technical Oversight Committee for this project. The project team reported on results of the HAZUS-MH sensitivity analysis, topographic and bathymetric data inventory, initial results of the remote sensing approaches to estimating aerodynamic surface roughness (z_0), and initial efforts to validate remote sensing-derived surface roughness values. Team members presented technical results at the Joint Agency Commercial Imagery Evaluation (JACIE) conference and at the American Society for Photogrammetry and Remote Sensing (ASPRS) annual meeting.

The project team made significant progress in FY05. The team developed an Interactive Data Language (IDL) process to directly derive surface roughness values from LiDAR data using a number of published algorithms. The project team used this tool to develop a 1-km resolution surface roughness map of the Broward County, FL study area to be evaluated against the current land use/land cover z_0 approach (using the 1992 NLCD), which is the HAZUS default. The team also developed and validated an ASTER-based 15-m land cover classification for the Pender/Onslow County study area in North Carolina; overall classification accuracy was 88%. The project team acquired the 2001 National Land Cover Dataset (NLCD) derived from Landsat data for the study area. In FY06, the team will convert the ASTER and 2001 NLCD classifications to surface roughness maps using updated z_0 lookup tables and then compare the results of HAZUS-MH with and without the ASTER/NLCD derived products.

In FY05, ARA initiated the integration of the WAVEWATCH III (WW3) deepwater wave model into HAZUS-MH for improved loss estimates as a result of storm surge associated with hurricanes. The project team conducted test runs of HAZUS-MH with and without results from WW3, serving as the basis of a HAZUS/WW3 benchmark report. The program expects to complete the benchmark report in early FY06 due to impacts and delays from Hurricane Katrina. The new version of HAZUS-MH, which incorporates WW3, is not expected to be publicly released until 2007.

AWIPS Systems Engineering and Evaluation

The project team produced a quick-look evaluation for the Advanced Weather Information Processing System (AWIPS) decision tool. The evaluation examined inputs, outputs, and opportunities for NASA-derived solutions that may benefit the system.

Hurricane Flood and Landslide Project (HFL): Detecting Tropical Floods and Landslides using NASA-based Precipitation Information

The program initiated activities in this HFL project, which is an interagency project to improve hurricane, flood, and landslide prediction capabilities for decision makers. This project extends NASA datasets of precipitation and land surface characteristics for use in quasi-global flood and landslide decision tools (developed by USGS and NOAA partners for USAID and NOAA/NWS use) for use in disaster management, response, preparedness and mitigation activities around the globe. The project will build on prior NASA work in the production of quasi-global precipitation information in real-time.

Fire Radiative Energy (FRE) Project

The Disaster Management program initiated a fire radiative detection study to further estimate the intensity of fire and aerosol production; this study is in partnership with the Air Quality program. In FY05, the project identified the basic relationship between the MODIS-measured FRE release rates and smoke aerosol emission rates. The project team performed the foregoing analysis using MODIS global fire and aerosol data acquired throughout 2002, and it derived C_e^{PM} for various biomass-burning regions.

The project team conducted an analysis to ensure that the developed methodology works globally. In FY06, the project team will extend this analysis to encompass five years of MODIS data in order to confirm the methodology and to derive C_e^{PM} for the entire North America at 1° resolution.

Southern Thunder

This project seeks to transition total lightning observations from the TRMM satellite (i.e., Lightning Imaging Sensor (LIS)) and ground-based research networks to improve the short-range prediction of severe weather. The project builds on U.S Weather Research Program and the World Meteorological Organization efforts to foster a national Nowcasting Test Bed; the team involves government, university, and industry partners.

In FY05, the project completed an initial total lightning verification, validation and benchmarking in AWIPS in collaboration with the NWS forecast offices at Huntsville (HUN) and Nashville (BNA). The project team presented the results at the *NWS Severe Weather Technology Workshop* in Silver Spring, Maryland. The team supported a community workshop in July 2005, which included a progress review and a reassessment of the end users' priorities. The project team developed several new training modules and presentations for the new MODIS and AMSR-E data products available in the Weather Forecast Office (WFO) via AWIPS. SPoRT is working with the UCAR/COMET program to convert these presentations to VISITview modules. Project team members gave the WFO HUN staff a presentation and overview of the new convective initiation products available within the AWIPS system. WFO HUN forecasters are now utilizing these products operationally, and an assessment period will occur in the future.

REASoN: Wildfire Research and Applications Partnership (WRAP) Report
The WRAP project extends NASA science and technology development in fire imaging to assist the U.S. Forest Service (USFS) in improving information gathering, reporting and managing of wildfire events. This project focuses on three main arenas of technology development: imaging technologies in thermal and mid-wave IR; test and evaluation of data telemetry technologies; and, strategies for improved data and information handling for decision support systems.

The project team continued to develop new algorithms for characterizing fire from MODIS, ASTER and airborne imagery. This effort complements work with the USFS to understand the value of different spectral bands for improved fire discrimination.

To evaluate the applicability of advanced platform technology, the project team held a demonstration of small unmanned aerial vehicles (UAVs) in July 2005. (The project delayed the Western States Mission, which is a demonstration on the Altair aircraft, until 2006.) The project team made enhancements to the Airborne Infrared Disaster Assessment System (AIRDAS) for use in the 2005 fire season. NASA-Ames and Fireball, Inc. developed a Space Act Agreement partnership to allow private enterprise modifications of the AIRDAS for improved utility for fire imaging. Fireball now uses the AIRDAS 3 (the most recent upgrade), and AIRDAS is one of three systems that USFS recognizes as a "Type 1" fire imaging system.

REASoN: Development of Remote Sensing-assisted Natural and Technological Hazards Decision Support Systems: University of South Carolina
This REASoN project entails four sub-projects – three on enhancements to spatial decision support systems related to natural and technological hazards and one on education and technology transfer from the other sub-projects. The three sub-projects address modeling of human risk and vulnerability to hazards, identifying remote sensing assets available at a disaster through a hazard guidance system, and improving technological hazards management through hazardous waste site monitoring tools.

In FY05, the project made significant progress in surveying the needs of state and federal response managers. The Savannah River National Laboratory (SRNL) joined the project, along with the University of South Carolina and U.S. EPA, to give hazard response personnel better access to needed information. SRNL 's role in the project is to focus on the development of high resolution remote sensing methodologies (e.g., hyperspectral) to detect imminent failure of closure caps, such as those used to close and protect areas where hazardous and radioactive waste has been disposed. SRNL partners are conducting tests at a set of experimental closure caps constructed near the Savannah River Site Burial Ground Complex.

SOLICITATIONS

Decisions CAN
The Disaster Management program received 74 Step-1 proposals in the Decisions CAN and encouraged 51 to submit full proposals. In Step-2, the Disaster Management program element received 52 full proposals, including 22 that overlapped with other program elements.

Following the panel reviews and internal assessment for programmatic balance, the Applied Sciences Program selected several Disaster Management proposals for awards. The Program selected one Disaster Management project in conjunction with Air Quality:

> Enhancements to the BlueSkyRAINS Emissions Assessment and Air Quality Prediction System
> *PI: Dana Sullivan, Sonoma Technology, Inc.*

The Applied Sciences Program selected the following proposals for a single, combined project serving the Disaster Management and Water Management program elements:

> Use of NASA Remote Sensing Datasets in NOAA National Weather Service River Forecast Centers' Hydrologic Modeling
> *PI: Ashutosh Limaye, Universities Space Research Association*
>
> Improving NOAA/NWS River Forecast Center Decision Support with NASA Satellite and Land Information System Products
> *PI: Pedro Restrepo, NOAA*

The Program selected the following proposals for a single, combined project serving the Disaster Management and Water Management program elements:

> National Drought Monitoring System for Drought Early Warning Using Hydrologic and Ecologic Observations from NASA Satellite Data
> *PI: Son V. Nghiem, NASA–Jet Propulsion Laboratory*
>
> Enhancement of the U.S. Drought Monitor by Integrating NASA Earth Science Data
> *PI: James Verdin, USGS EROS Data Center*

The Program selected the following proposals for a single, combined project serving the Disaster Management, Public Health, and Agricultural Efficiency program elements:

> Integrating NASA Earth Science Results into Malaria Early Warning Products to Enhance USAID Food Security and Disaster Management Decision Making
> *PI: James Verdin, USGS EROS Data Center*
>
> Enhancing the Famine Early Warning System Network Decision Support System with NASA Earth System Science Data and Modeling Results
> *PI: Molly Elizabeth Brown, NASA Goddard Space Flight Center*

The Applied Sciences Program later selected additional proposals for one-year awards from a Congressionally-directed augmentation, including one project for the Disaster Management program portfolio (in conjunction with the Water Management program):

> Flood Inundation Enhancement for NOAA's Advanced Hydrologic Prediction Service
> *PI: G. Robert Brakenridge, Dartmouth College*

PUBLICATIONS (SELECTED)

Ambrose, S., S. Habib, and R. McKellip, "Extending NASA Research Capabilities For Disaster Management," *EOM*, August 2005.

Ambrose, S. (contributor), *Know Risk*, published by UN prior to Kobe Disaster Management Workshop, December 2004.

Golden, M., R. Downs, and K. Davis-Packard, *Confidentiality Issues and Policies Related to the Utilization and Dissemination of Geospatial Data for Public Health Applications*, March 2005. *http://www.ciesin.columbia.edu/pdf/SEDAC_ConfidentialityReport.pdf.*

Ambrose, S., and S. Falke, "Earth Observations Enhance Fire and Smoke Decision Support Systems in the Eastern United States," EastFire Conference Article of Selected Papers, *EOM*, August, 2005.

CONFERENCE/WORKSHOP PRESENTATIONS AND POSTERS (SELECTED)

Ambrose, S., "Extension of NASA's Science and Technology Results, Earth Observations for Decision Support," *Geo-information for Disaster Management* (Gi4DM), Delft, Netherlands, March, 2005.

Ambrose, S., and S. Habib, "Earth Observations Applied to Decision Support," *IGARSS 2005*, S. Korea, July 2005.

The Disaster Management program also participated actively in the following workshops, conferences, and symposia: IGARSS, ISRSE, SPIE, SENH Workshop, Disasters Roundtable, UNOOSA Disaster Management meeting (Munich), NRC Transportation Review Board Meeting (Washington, DC, January 2005), TIGER Workshop (Africa), and Gi4DM.

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